

providing illumination by way of a plurality of different independent paths through a specimen having a characteristic to be measured;

sensing a plurality of independent signals developed at the same time or in rapid sequence representing optical information obtained from said specimen in response to said illumination, each independent signal corresponding to a particular path; and

processing said signals in accordance with appropriate modeling techniques to minimize inaccuracies in spectroscopic determination of qualitative or quantitative characteristics of the specimen.

modulating 4. (Amended) The method of claim 2 including the step of providing the illumination of the specimen modulated at different frequencies along said different paths respectively for distinguishing the ~~independent~~ ^{material} ~~for each different path~~ one independent sensed signal from another.

AJ 5. (Amended) The method of claim 2 including the step of providing illumination of the specimen with different time sequence codes along said different paths respectively for distinguishing the ~~independent~~ ^{material} ~~for each different path~~ one independent sensed signal from another.

7. (Amended) Apparatus for improving optical interactance measurements comprising:

A3 means for providing illumination to a specimen having a characteristic to be measured along a plurality of different paths;

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means for sensing optical information developed by said illumination provided from an illuminated specimen;

means, responsive to said sensed optical information, for developing a plurality of independent signals corresponding in number to said plurality of paths, said signals representing said optical information obtained from said specimen; and

means for processing said signals in accordance with appropriate modeling techniques to minimize inaccuracies in spectroscopic determination of quantitative or qualitative characteristics of the specimen.

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10. (Amended) The apparatus of claim 7 including means for modulating said illumination provided to said paths so that each path ^{has} ~~had~~ a different modulating characteristic, said apparatus also including means responsive to said independent signals for demodulating said signals.

11. (Amended) Apparatus for improving optical interactance, transmittance and reflectance measurements comprising:

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an elongated probe having a body portion and a tip portion, the body portion comprising a central tubular element surrounded by an annular outer element;

the tip portion having a central aperture which communicates with said central tubular element and at least one ring which communicate with said annular outer element;

the ring or rings in said tip portion being angled with respect to the longitudinal axis of the probe;

a number of fiber optic bundles whose number corresponds to said [plurality of] ring or rings being disposed within said outer element, each bundle being arranged at one end to exit at a respective ring and, at the other end, at least one such bundle to be connected to a source of illumination; and

optical means disposed in the central tubular element for receiving optical information resulting from applied illumination to a specimen from said central aperture from a specimen and for conveying said information to a sensing device so as to develop signals representing said specimen optical information.

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18. (Amended) The apparatus of claim 11 also including fiber optic means and a detector for [monitoring the energy] providing a signal representative of the illumination received by the specimen.

20. (Amended) [A] In a method of using [the] apparatus for improving optical interactance measurements comprising means for providing illumination to a specimen having a characteristic to be measured along a plurality of different paths, means for sensing optical information developed by said illumination provided from an illuminated specimen, means, responsive to said sensed optical information, for developing a plurality of independent signals corresponding in number to said plurality of paths, said signals representing said optical information obtained from said specimen, and means for processing said signals in accordance with appropriate modeling techniques to

minimize inaccuracies in spectroscopic determination of quantitative or qualitative characteristics of the specimen [of claim 7 or claim 11], said method including the step of arranging
the tip of the probe adjacent a specimen of small size so that reflected energy from said specimen is directed to said central aperture.

21. (Amended) [A] In a method of using [the] apparatus for improving optical interactance measurements comprising means for providing illumination to a specimen having a characteristic to be measured along a plurality of different paths, means for sensing optical information developed by said illumination provided from an illuminated specimen, means, responsive to said sensed optical information, for developing a plurality of independent signals corresponding in number to said plurality of paths, said signals representing said optical information obtained from said specimen and means for processing said signals in accordance with appropriate modeling techniques to minimize inaccuracies in spectroscopic determination of quantitative or qualitative characteristics of the specimen [of claim 7 or claim 11], said method including the steps of arranging
the tip of the probe adjacent a specimen of small size and using fiber optic elements to receive energy transmitted through said specimen to said central aperture.

22. [A] In a method of using [the] apparatus for improving optical interactance measurements comprising, means for providing illumination to a specimen having a characteristic to

~~be measured along a plurality of different paths, means for sensing optical information developed by said illumination provided from an illuminated specimen, means, responsive to said sensed optical information, for developing a plurality of independent signals corresponding in number to said plurality of paths, said signals representing said optical information obtained from said specimen, and means for processing said signals in accordance with appropriate modeling techniques to minimize inaccuracies in spectroscopic determination of quantitative or qualitative characteristics of the specimen [of claim 7 or claim 11], said method including the step of providing a further source of illumination, arranging (the tip of the probe) adjacent a near side of a specimen of small size, arranging the further source of illumination on a far side of said specimen, using (said probe) so that reflected energy from said specimen is directed to (said central aperture) and/or energy transmitted by said further source through said specimen is directed to (said central aperture.)~~

Claim 23, line 1, delete "A" insert -- In a --.

24. [A] ~~In a method of using [the] apparatus for improving optical interactance measurements comprising means for providing illumination to a specimen having a characteristic to be measured along a plurality of different paths, means for sensing optical information developed by said illumination provided from an illuminated specimen, means, responsive to said sensed optical information, for developing a plurality of~~

independent signals corresponding in number to said plurality of paths, said signals representing said optical information obtained from said specimen, and means for processing said signals in accordance with appropriate modeling techniques to minimize inaccuracies in spectroscopic determination of quantitative or qualitative characteristics of the specimen [of claim 7 or claim 11], said method including the steps of providing a further detector for developing an electrical signal responsive to illumination, arranging the top of (the probe) adjacent the near side of a specimen of small size, arranging said further detector on a far side of said specimen, using said probe so that reflected energy from said specimen is directed to < said central aperture > and/or energy transmittal by said probe is detected by said further detector.

Claim 25, line 1, delete "A" and insert -- In a --.

Claim 26, line 20, after "signals" insert -- responsive to said illumination --.

Please add new claims 26-31 as follows:

27. In a method of using apparatus for improving optical interactance, transmittance and reflectance measurements comprising an elongated probe having a body portion and a tip portion, the body portion comprising a central tubular element surrounded by an annular outer element, the tip portion having a central aperture which communicates with said central tubular element and at least one ring which communicate with said annular outer element, the ring or rings in said tip portion being angled

with respect to the longitudinal axis of the probe, a number of fiber optic bundles whose number corresponds to said ring or rings being disposed within said outer element, each bundle being arranged at one end to exit at a respective ring and, at the other end, at least one such bundle to be connected to a source of illumination, and optical means disposed in the central tubular element for receiving optical information resulting from applied illumination to a specimen from said central aperture from a specimen and for conveying said information to a sensing device so as to develop signals representing said specimen optical information, said method including the step of arranging the tip of the probe adjacent a specimen of small size so that reflected energy from said specimen is directed to said central aperture.

28. In a method of using apparatus for improving optical interactance, transmittance and reflectance measurements comprising an elongated probe having a body portion and a tip portion, the body portion comprising a central tubular element surrounded by an annular outer element, the tip portion having a central aperture which communicates with said central tubular element and at least one ring which communicate with said annular outer element, the ring or rings in said tip portion being angled with respect to the longitudinal axis of the probe, a number of fiber optic bundles whose number corresponds to said ring or rings being disposed within said outer element, each bundle being arranged at one end to exit at a respective ring and, at the

other end, at least one such bundle to be connected to a source of illumination, and optical means disposed in the central tubular element for receiving optical information resulting from applied illumination to a specimen from said central aperture from a specimen and for conveying said information to a sensing device so as to develop signals representing said specimen optical information, said method including the steps of arranging the tip of the probe adjacent a specimen of small size and using fiber optic elements to receive energy transmitted through said specimen to said central aperture.

29. In a method of using apparatus for improving optical interactance, transmittance and reflectance measurements comprising an elongated probe having a body portion and a tip portion, the body portion comprising a central tubular element surrounded by an annular outer element, the tip portion having a central aperture which communicates with said central tubular element and at least one ring which communicate with said annular outer element, the ring or rings in said tip portion being angled with respect to the longitudinal axis of the probe, a number of fiber optic bundles whose number corresponds to said ring or rings being disposed within said outer element, each bundle being arranged at one end to exit at a respective ring and, at the other end, at least one such bundle to be connected to a source of illumination, and optical means disposed in the central tubular element for receiving optical information resulting from applied illumination to a specimen from said central aperture

from a specimen and for conveying said information to a sensing device so as to develop signals representing said specimen optical information including the step of providing a further source of illumination, arranging the tip of the probe adjacent a near side of a specimen of small size, arranging the further source of illumination on a far side of said specimen, using said probe so that reflected energy from said specimen is directed to said central aperture and/or energy transmitted by said further source through said specimen is directed to said central aperture.

30. In a method as in claim 29 including the step of selectively choosing an operational mode of reflectance, transmittance or combined reflectance and transmittance.

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31. In a method of using apparatus of for improving optical interactance, transmittance and reflectance measurements comprising an elongated probe having a body portion and a tip portion, the body portion comprising a central tubular element surrounded by an annular outer element, the tip portion having a central aperture which communicates with said central tubular element and at least one ring which communicate with said annular outer element, the ring or rings in said tip portion being angled with respect to the longitudinal axis of the probe, a number of fiber optic bundles whose number corresponds to said ring or rings being disposed within said outer element, each bundle being arranged at one end to exit at a respective ring and, at the other end, at least one such bundle to be connected to a source

to a source of illumination, and optical means disposed in the central tubular element for receiving optical information resulting from applied illumination to a specimen from said central aperture from a specimen and for conveying said information to a sensing device so as to develop signals representing said specimen optical information, said method including the steps of providing a further detector for developing an electrical signal responsive to illumination, arranging the top of the probe adjacent the near side of a specimen of small size, arranging said further detector on a far side of said specimen, using said probe so that reflected energy from said specimen is directed to said central aperture and/or energy transmittal by said probe is detected by said further detector.

sub. ct 32. In a method as in claim 31 including the step of selectively choosing an operational mode of reflectance, transmittance or combined reflectance and transmittance.

REMARKS

Applicant has amended claims 1, 4, 7, 10, 11, 18, 20-25 and 26, has canceled claim 16 without prejudice and has added new claims 27-32. Claims 1-15 and 17-32 are in the application.

With respect to the claims, the Examiner had rejected claims 1-26 under 35 U.S.C. § 112, second paragraph as being indefinite. In response to this rejection, Applicant has revised the claims throughout. While most of the amendments are self-